

Army Fire Support Investment Framework

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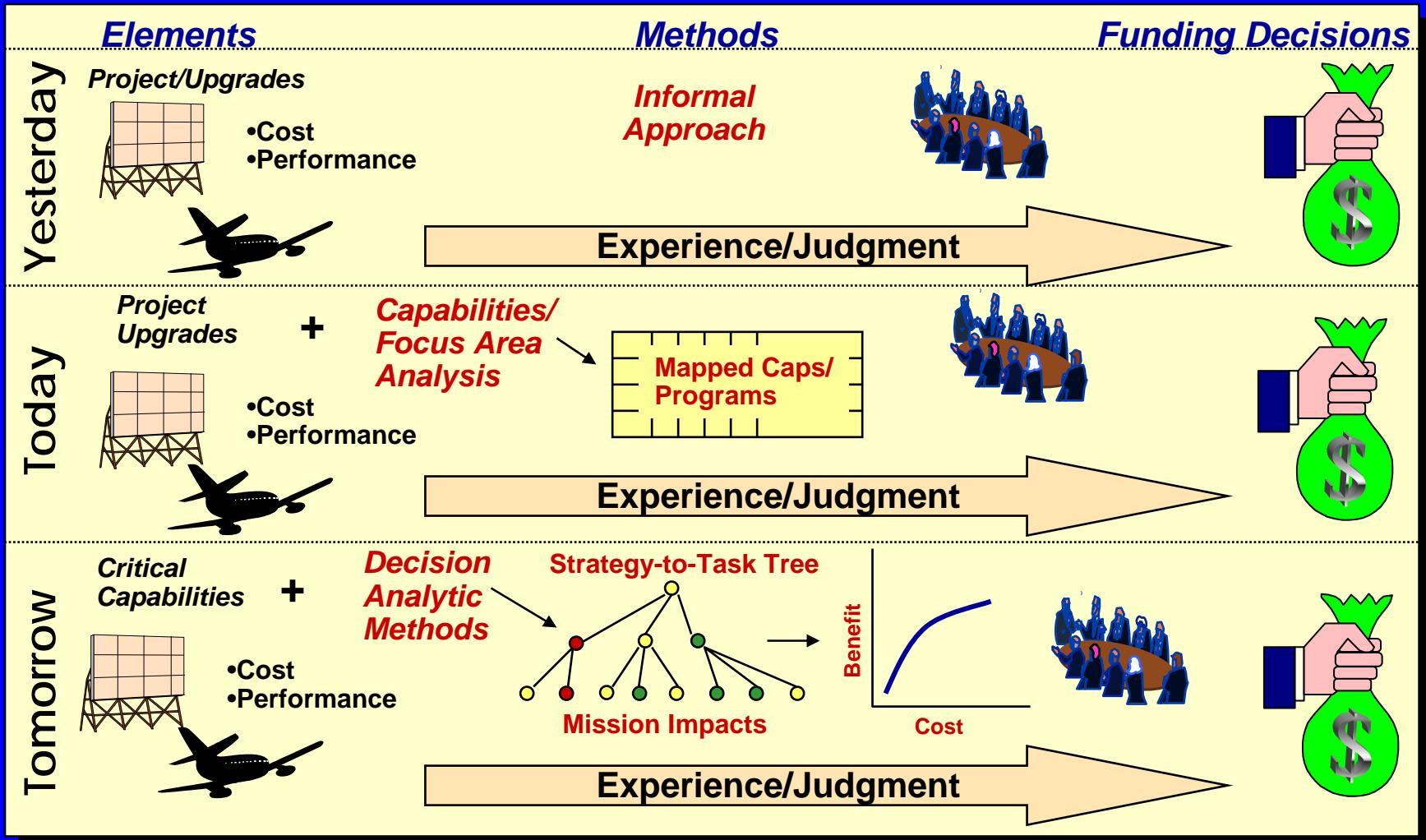
Goal of the Analysis

Develop a framework to support System-of-Systems investment decisions using the Army Fire Support Battlefield Operating System as a pilot

Concept: *Apply a capability-based analysis approach*

Background

Move Towards A Capability-Driven Investment Decision Making



DoD Guidance for Capability-Based Investment Analysis & Data Sources for Fire Support Mission Breakout

- **Guidance:** CJCSI 3170.01C requires implementation of a capabilities-based methodology to support development of integrated architectures.
 - “The methodology must provide end-to-end traceability of DOTML-PF solutions through the capabilities supported for each Joint Functional Concept.”
- TRADOC Pamphlet 525-3-9, Future Force Fire and Effects Concept of Operation, September 2003.
- FM6-20-10 Targeting Doctrine
- Army Precision Engagement (PE) Architecture
 - Part of Capabilities-Based Objective Force Architecture developed by Army Architecture Integration Cell

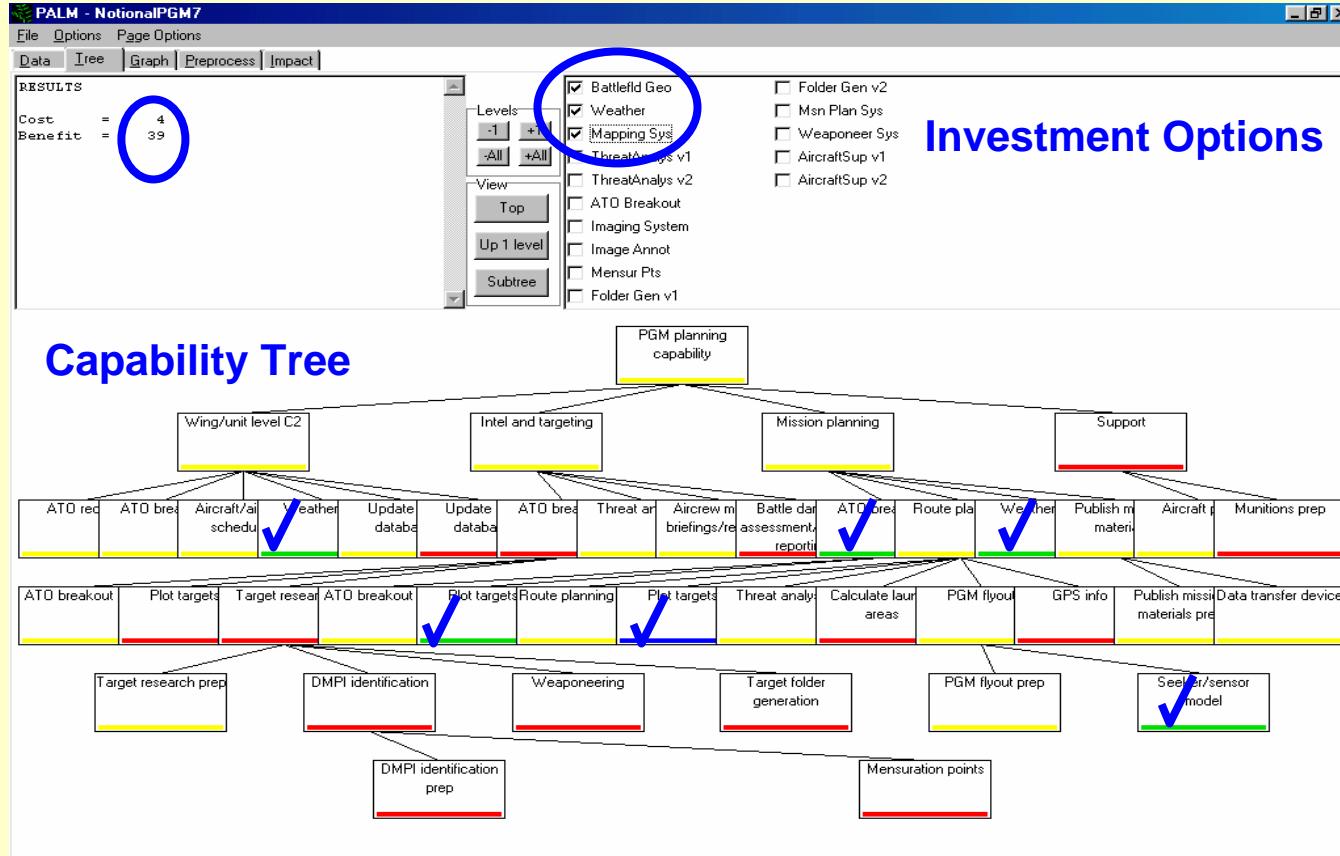
Key Tool: The Portfolio AnaLysis Machine (PALMA)

- PALMA is a decision support tool developed by MITRE that facilitates **Capability-Based** investment planning
- Supports an investment strategy *process*
- Brings together:
 - The investment options
 - Their cost
 - What they do for you (detailed impacts)
 - How that fits into your overall goals (mission performance from detailed impacts)
- Finds the best portfolio of investments based on cost and mission-level benefit

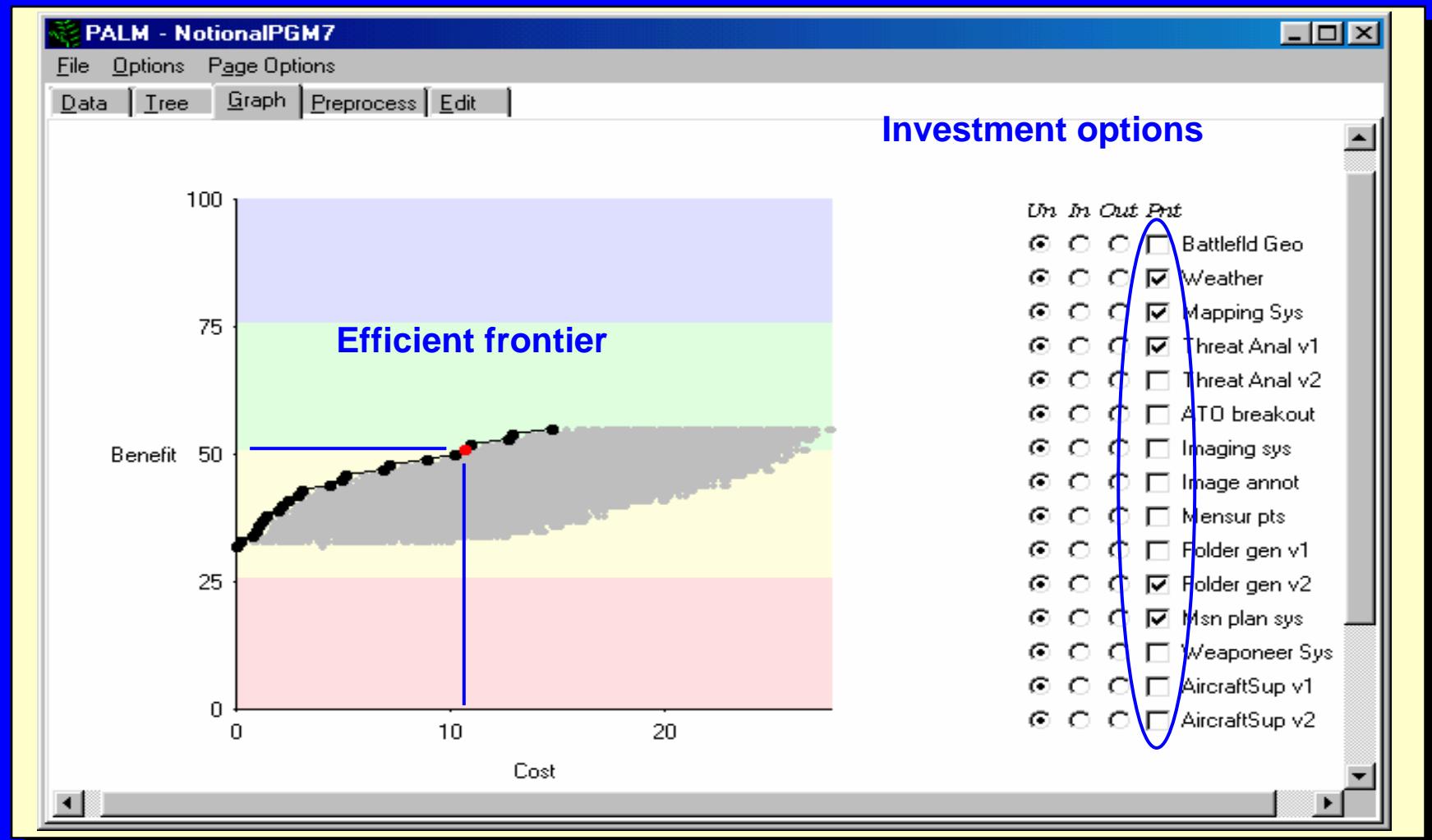
Steps in Applying a Portfolio Analysis Approach

- Build the mission capability “strategy-to-task” tree hierarchy
- Develop “roll-up” performance combination rules from functions to lower-level tasks
- Make baseline performance assessments for lowest level tasks
- Identify investment options and map their impact to specific tasks in the capability tree
- Apply decision analytic methodologies/tools
- Gain insights to make investment recommendations

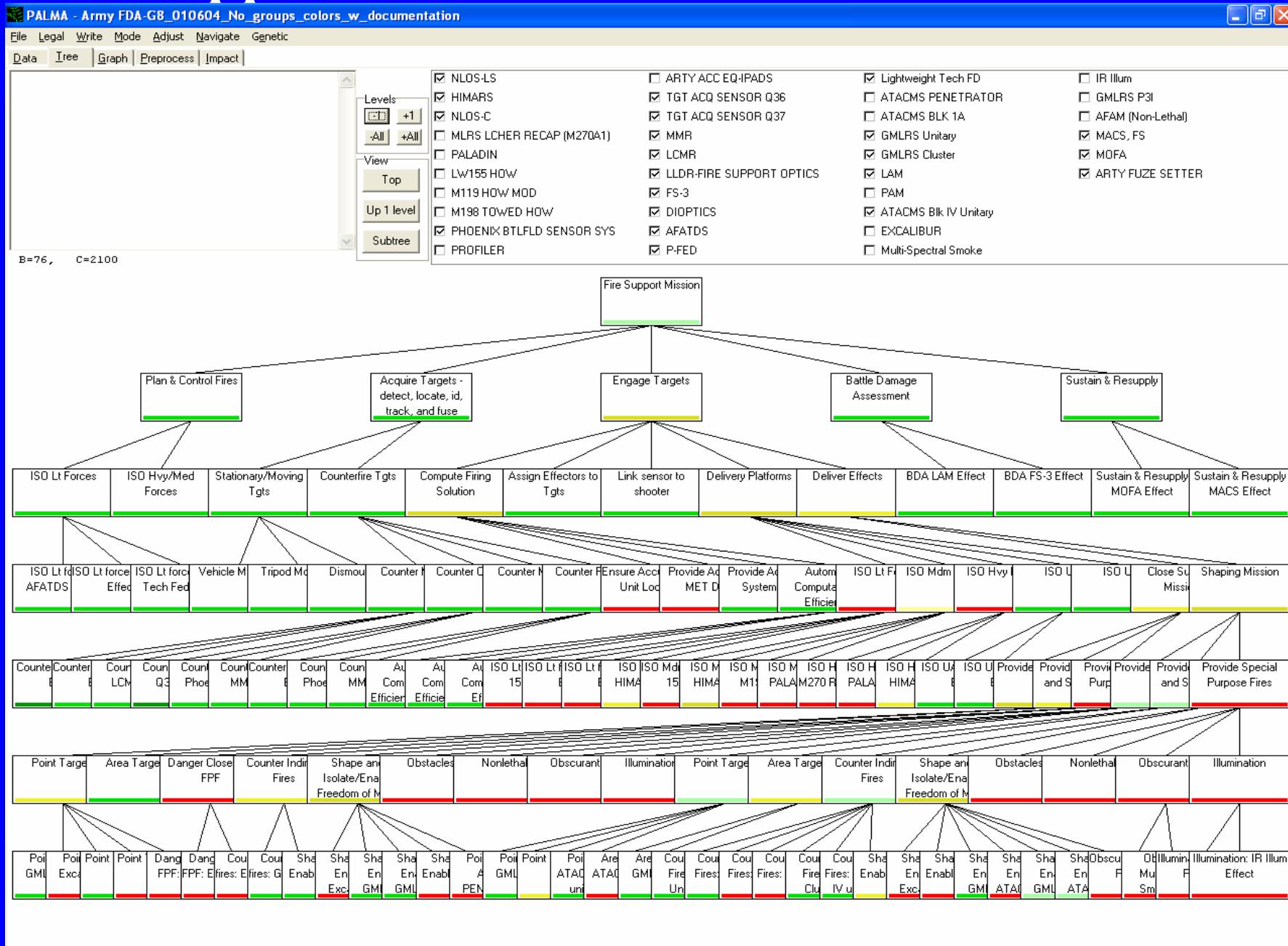
PALMA “Tree” Page



PALMA “Graph” Page



Fire Support Mission Breakout



Plan and Control Fires Subtree

PALMA - Army FDA-G8_010604_No_groups_colors_w_documentation

File Legal Write Mode Adjust Navigate Genetic
Data Tree Graph Preprocess Impact

Node 1.11
ISO Lt forces: AFATDS Effect
abbrev = ISOLtforAF
color = red
color# = 17
rule = *
return = 0.1250
Affected by options:
*19 AFATDS green (83)
B=55, C=2000

Levels: -1, +1, All, +All
View: Top, Up 1 level, Subtree

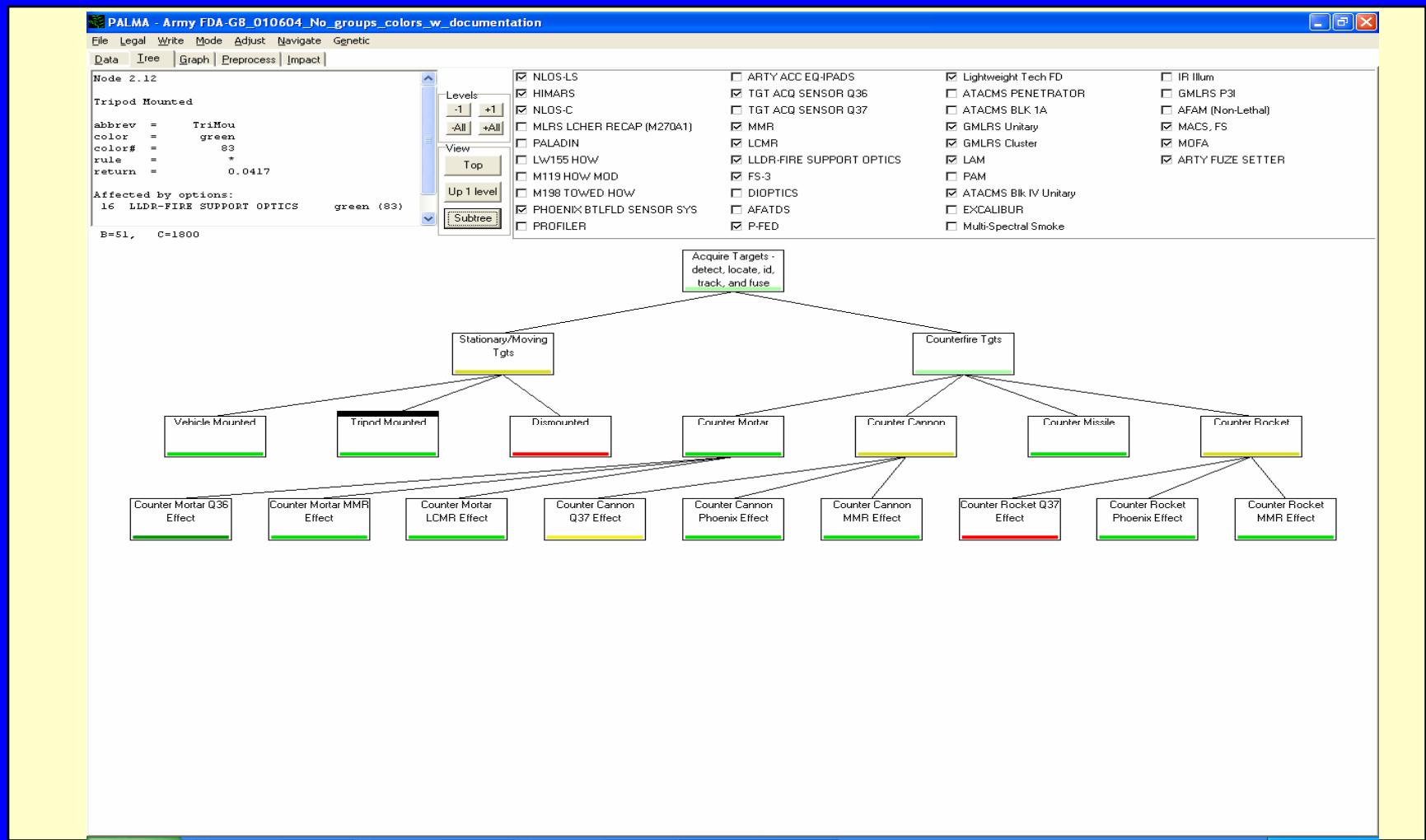
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<input checked="" type="checkbox"/> HIMARS	<input checked="" type="checkbox"/> TGT ACQ SENSOR Q36	<input type="checkbox"/> ATACMS PENETRATOR	<input type="checkbox"/> GMLRS P3I
<input checked="" type="checkbox"/> NLOS-C	<input checked="" type="checkbox"/> TGT ACQ SENSOR Q37	<input type="checkbox"/> ATACMS BLK 1A	<input type="checkbox"/> AFAM (Non-Lethal)
<input type="checkbox"/> MLRS LCHER RECAP (M270A1)	<input checked="" type="checkbox"/> MMR	<input checked="" type="checkbox"/> GMLRS Unitary	<input checked="" type="checkbox"/> MACS, FS
<input type="checkbox"/> PALADIN	<input checked="" type="checkbox"/> LCMR	<input checked="" type="checkbox"/> GMLRS Cluster	<input checked="" type="checkbox"/> MOFA
<input type="checkbox"/> LW155 HOW	<input type="checkbox"/> LLDR-FIRE SUPPORT OPTICS	<input checked="" type="checkbox"/> LAM	<input type="checkbox"/> ARTY FUZE SETTER
<input type="checkbox"/> M119 HOW MOD	<input checked="" type="checkbox"/> FS-3	<input type="checkbox"/> PAM	
<input type="checkbox"/> M198 TOWED HOW	<input checked="" type="checkbox"/> DIOPTICS	<input checked="" type="checkbox"/> ATACMS Blk IV Unitary	
<input type="checkbox"/> PHOENIX BTLFLD SENSOR SYS	<input type="checkbox"/> AFATDS	<input type="checkbox"/> EXCALIBUR	
<input type="checkbox"/> PROFILER	<input checked="" type="checkbox"/> P-FED	<input type="checkbox"/> Multi-Spectral Smoke	

Plan & Control Fires

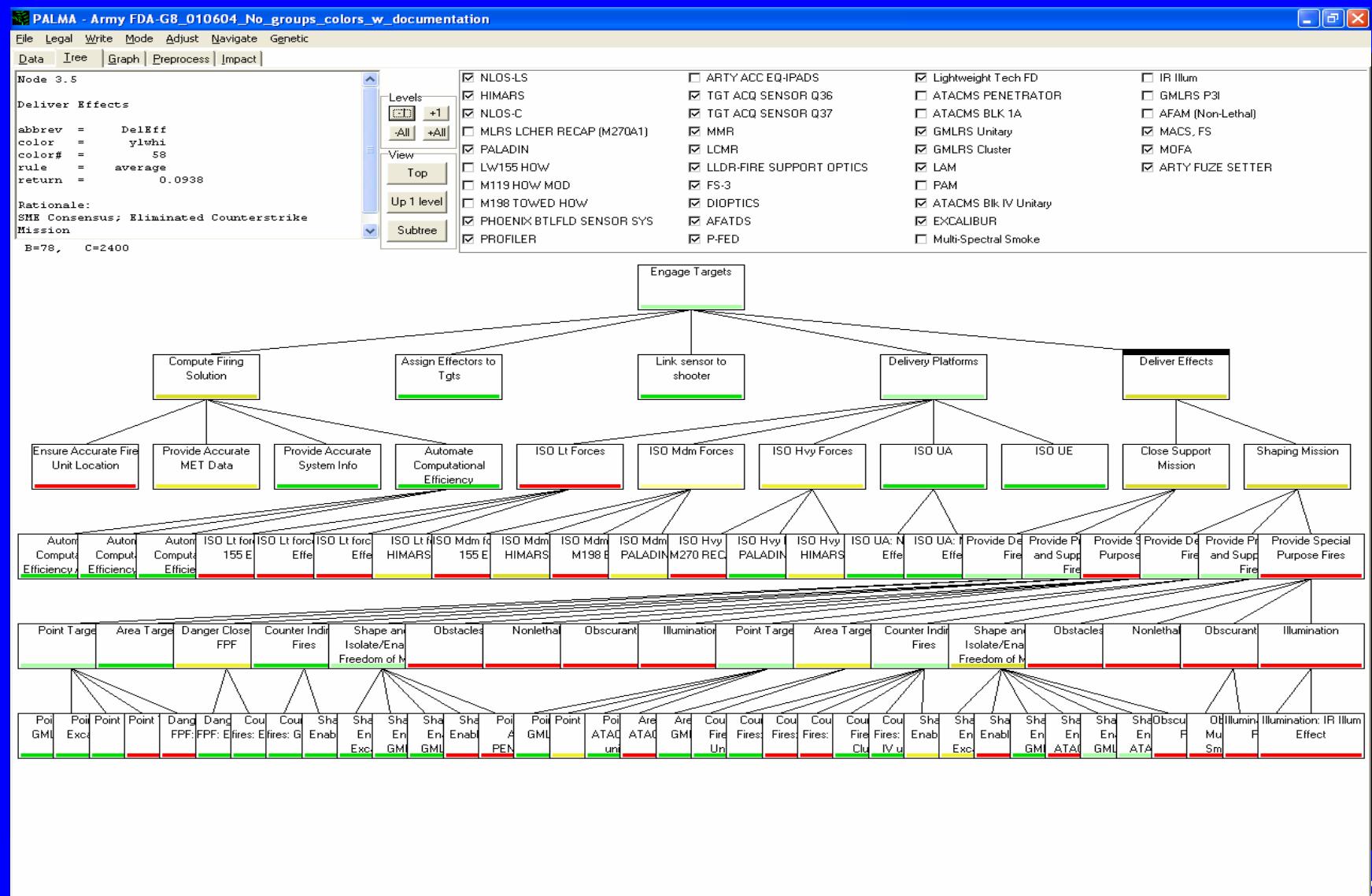
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graph TD; Plan[Plan & Control Fires] --> ISO_Lt[ISO Lt Forces]; Plan --> ISO_Hyv[ISO Hyv/Med Forces]; ISO_Lt --> AFATDS[ISO Lt forces: AFATDS Effect]; ISO_Lt --> P_FED[ISO Lt forces: P-FED Effect]; ISO_Lt --> Tech_Fed[ISO Lt forces: LWT Tech Fed Effect]
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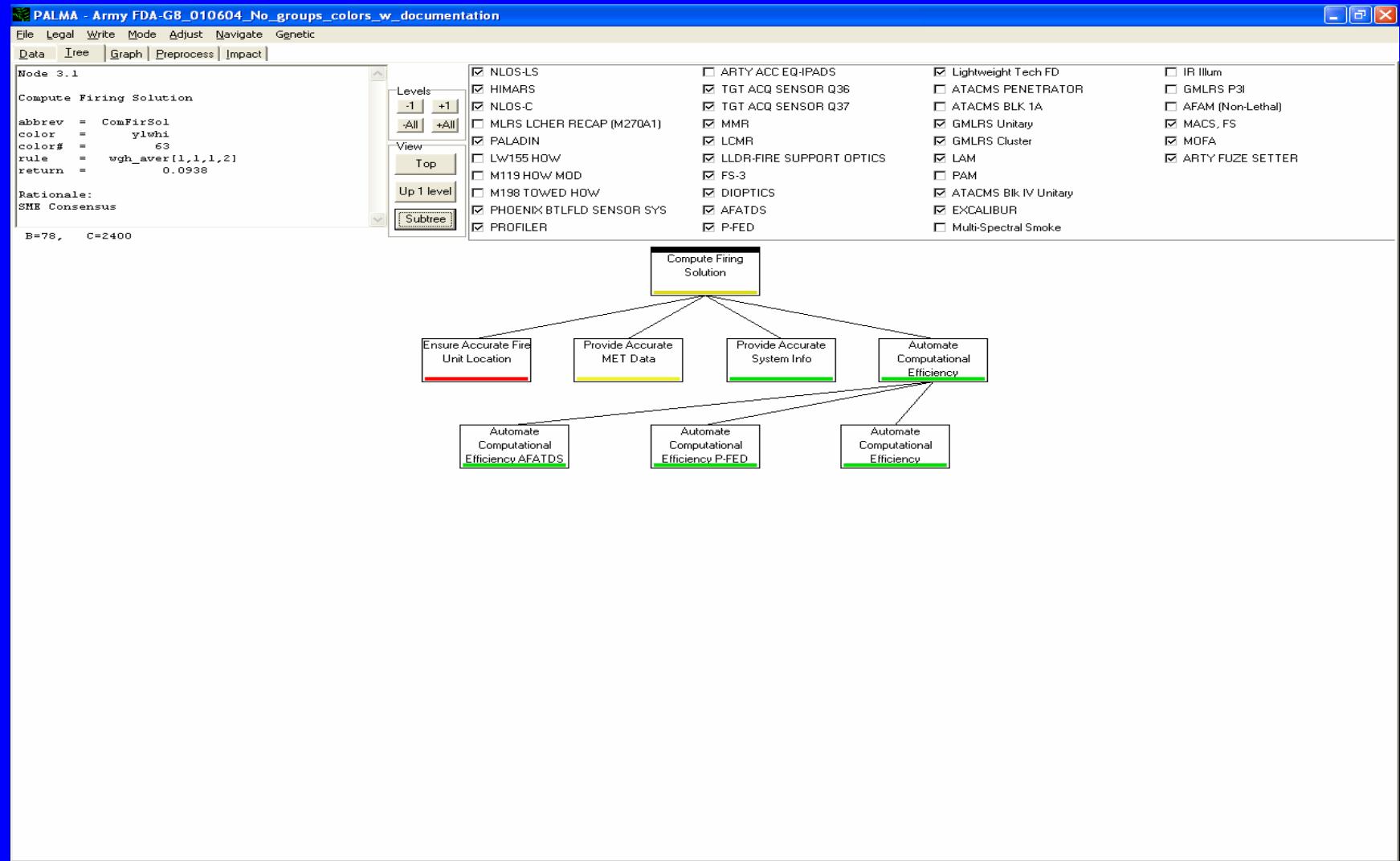
Acquire Targets Subtree



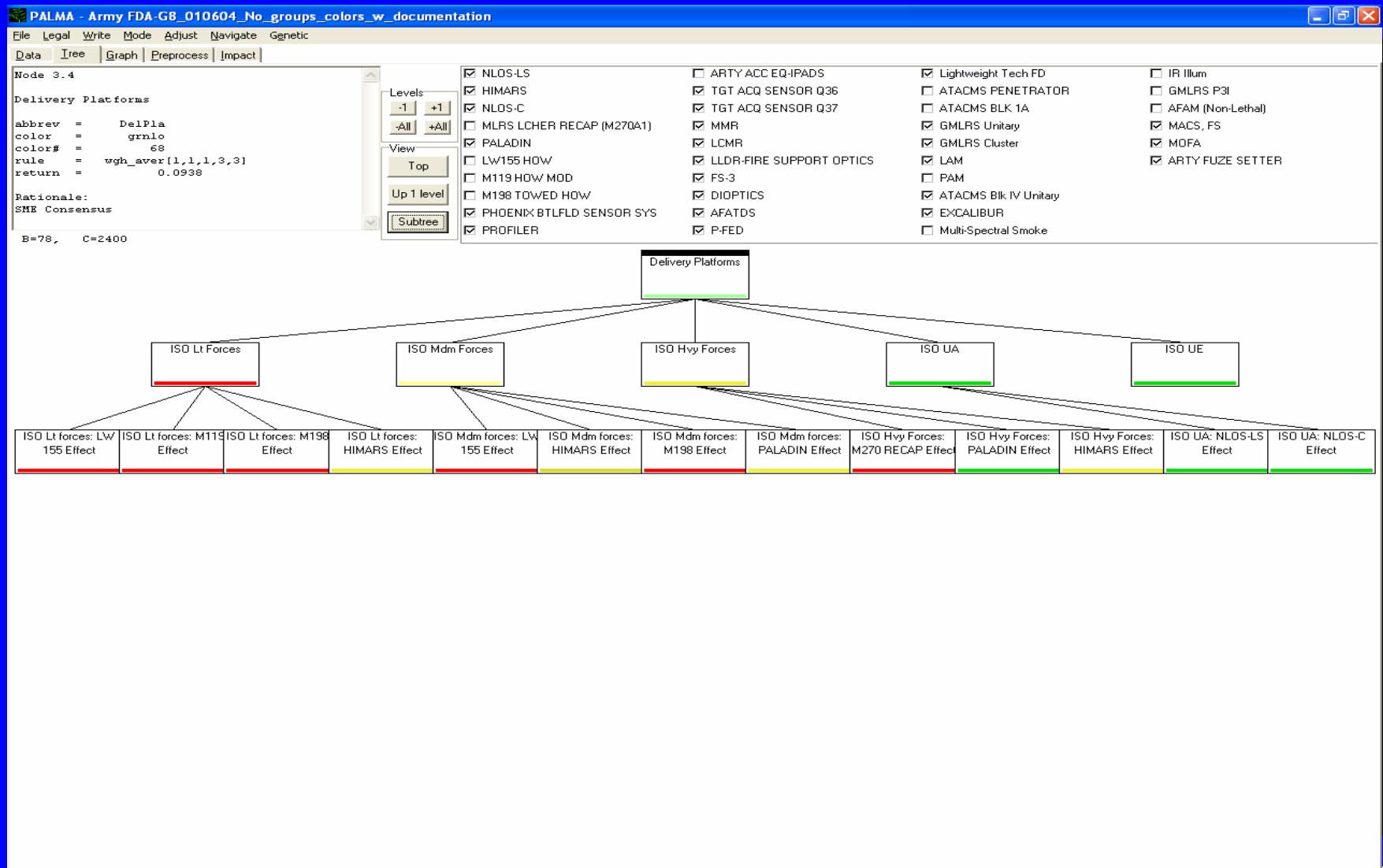
Engage Targets Subtree



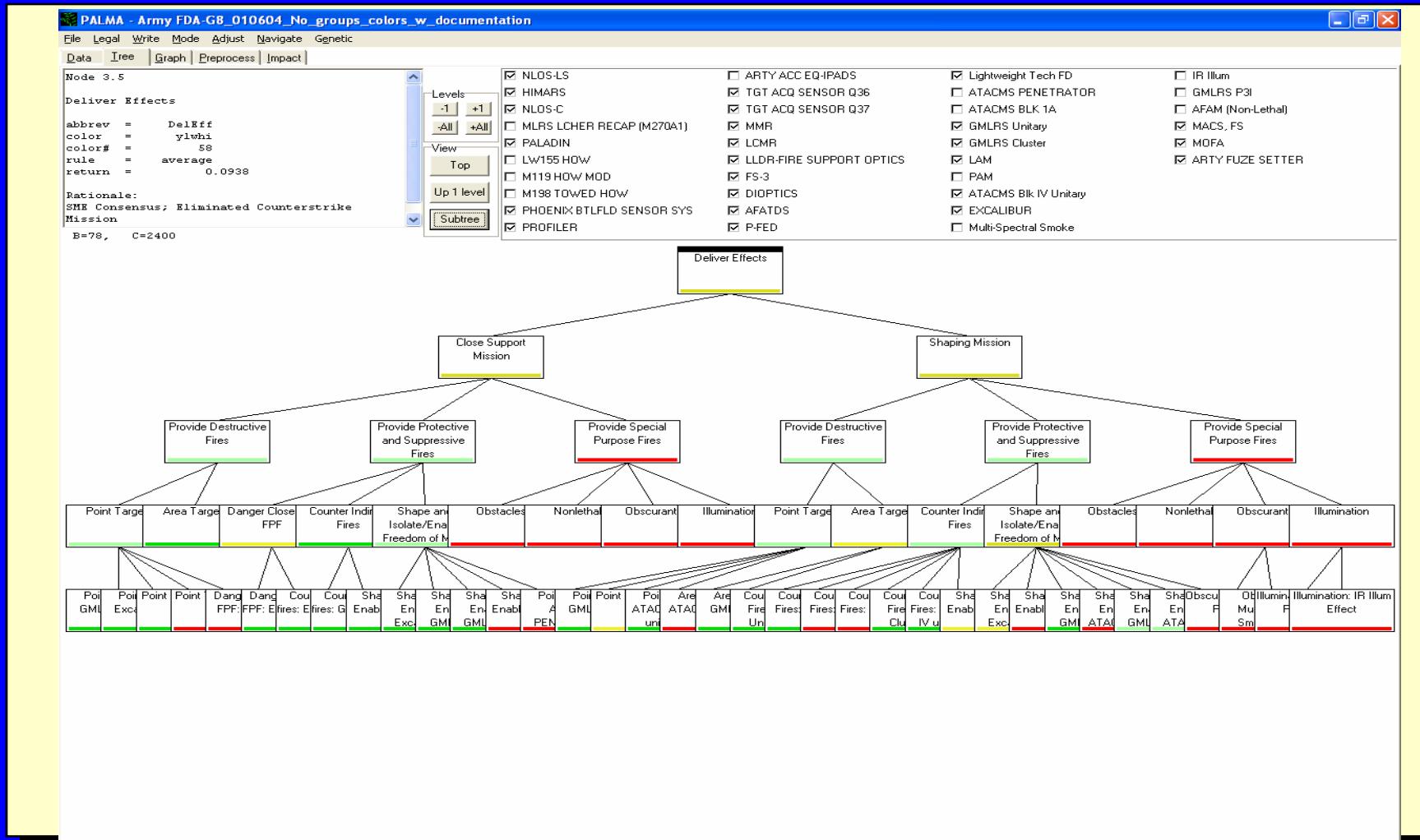
Engage Targets/Compute Firing Solution Breakout



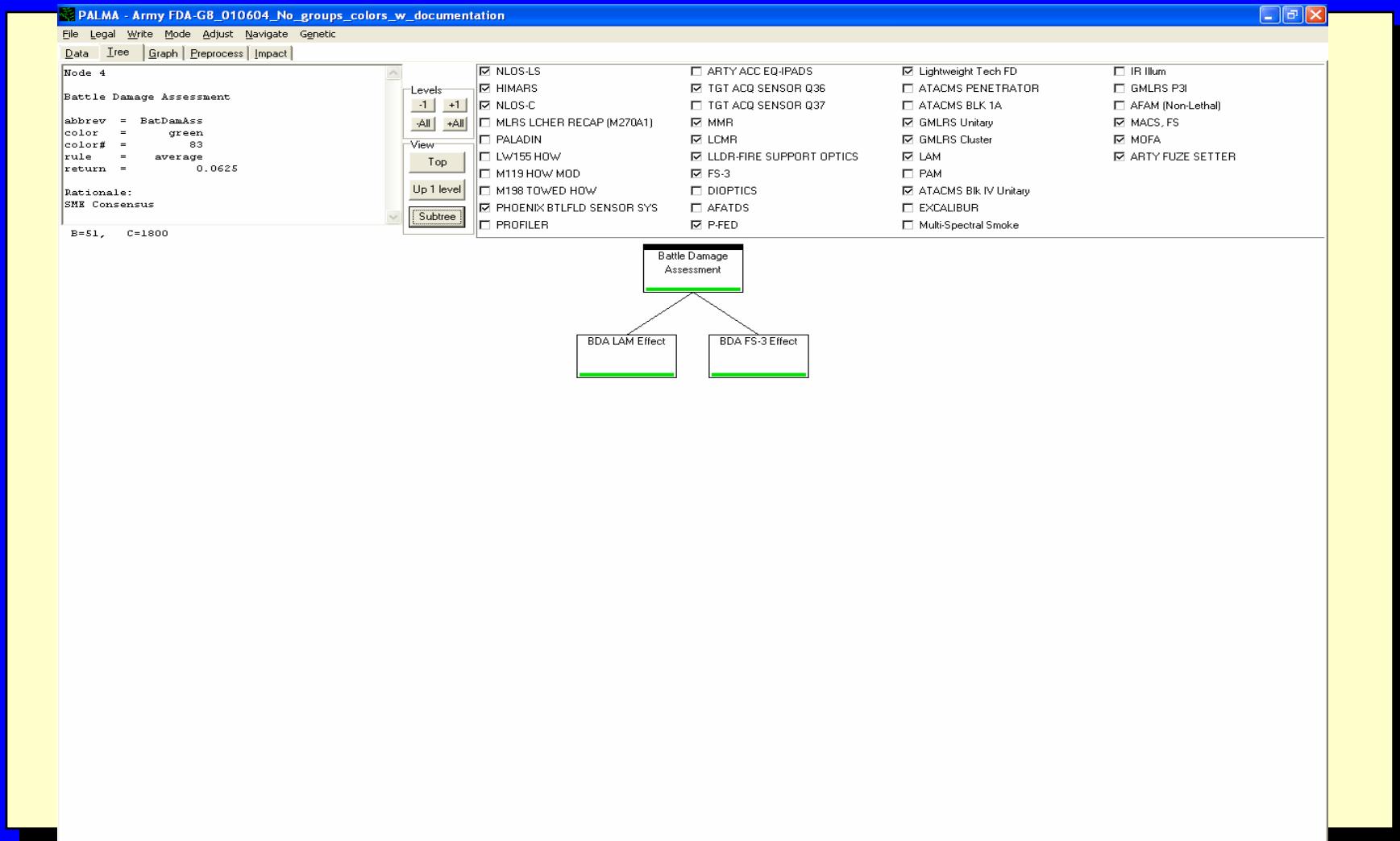
Engage Targets/Delivery Platforms Breakout



Engage Targets/Deliver Effects Breakout



Battle Damage Assessment Subtree



Sustain and Resupply Subtree

PALMA - Army FDA-GB_010604_No_groups_colors_w_documentation

File Legal Write Mode Adjust Navigate Genetic

Data Tree Graph Preprocess Impact

Node 5

Sustain & Resupply

abbrev = Susa&Res
color = green
color# = 83
rule = min
return = 0.0625

Rationale:
Need both options for green; red without both options

B=51, C=1800

Levels: -1 +1 All +All

View: Top Up 1 level Subtree

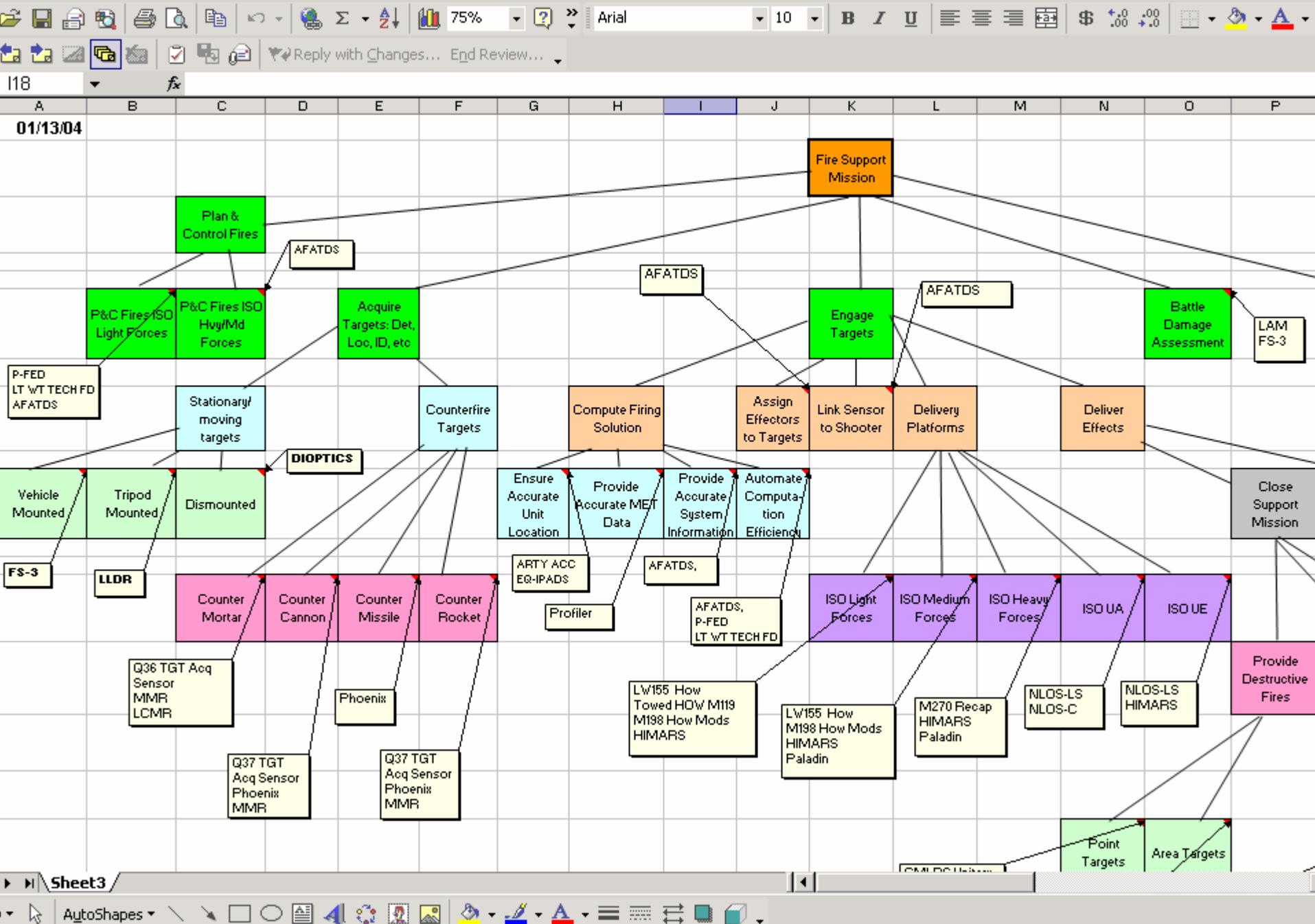
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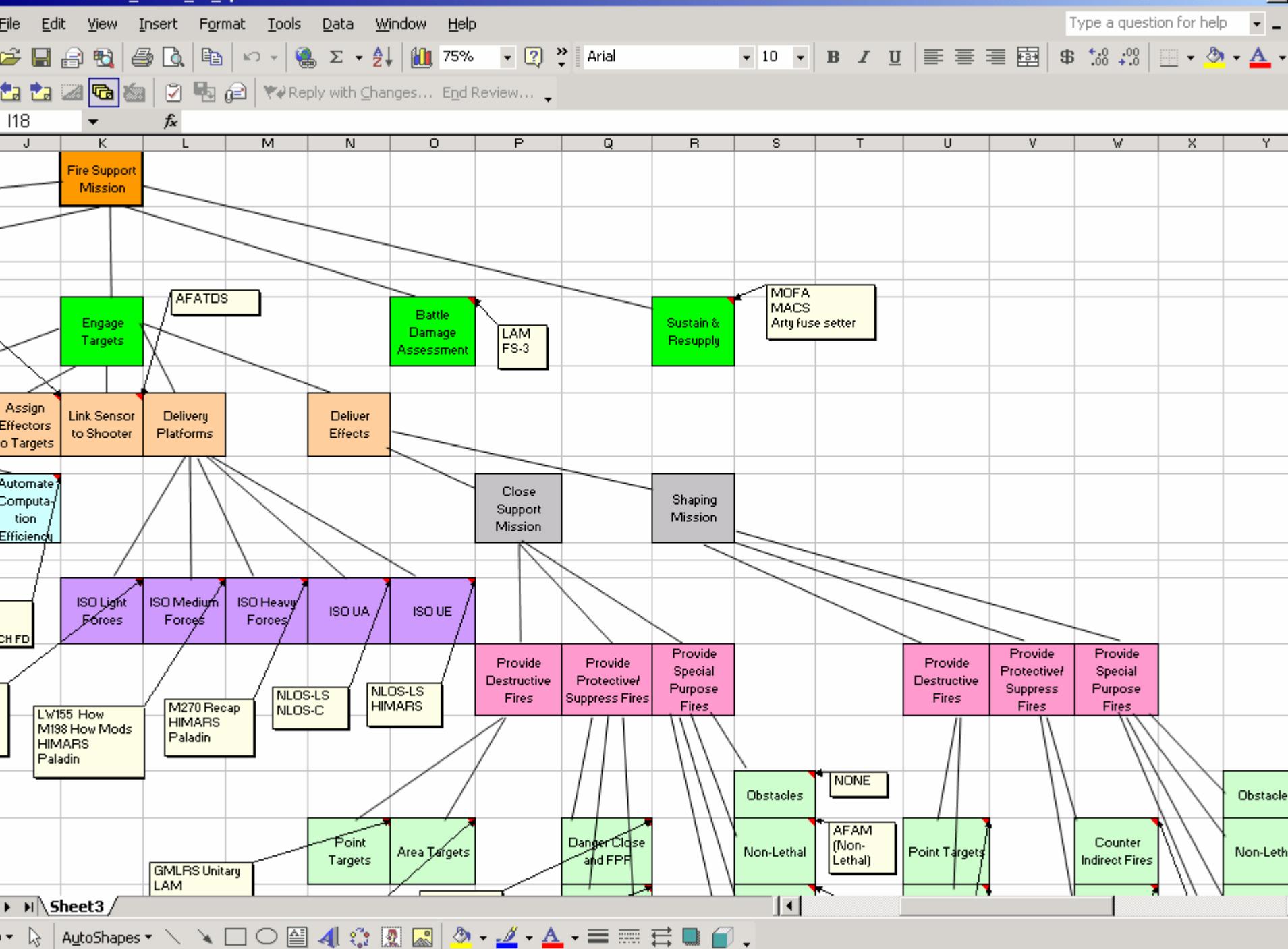
Sustain & Resupply

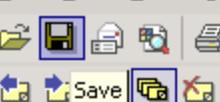
Sustain & Resupply MOFA Effect

Sustain & Resupply MACS Effect

Matching of Systems to PALMA Leaf Nodes



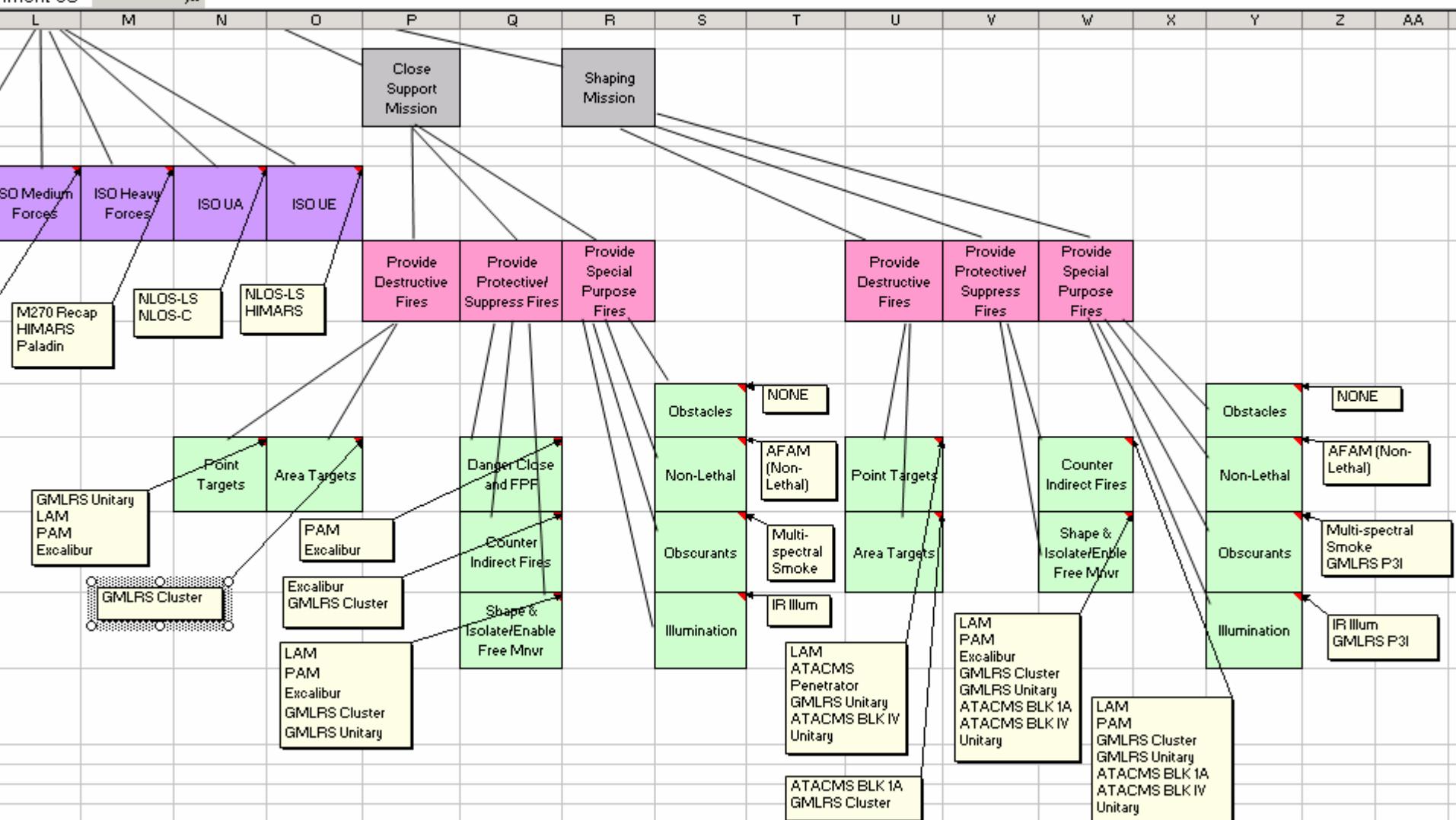




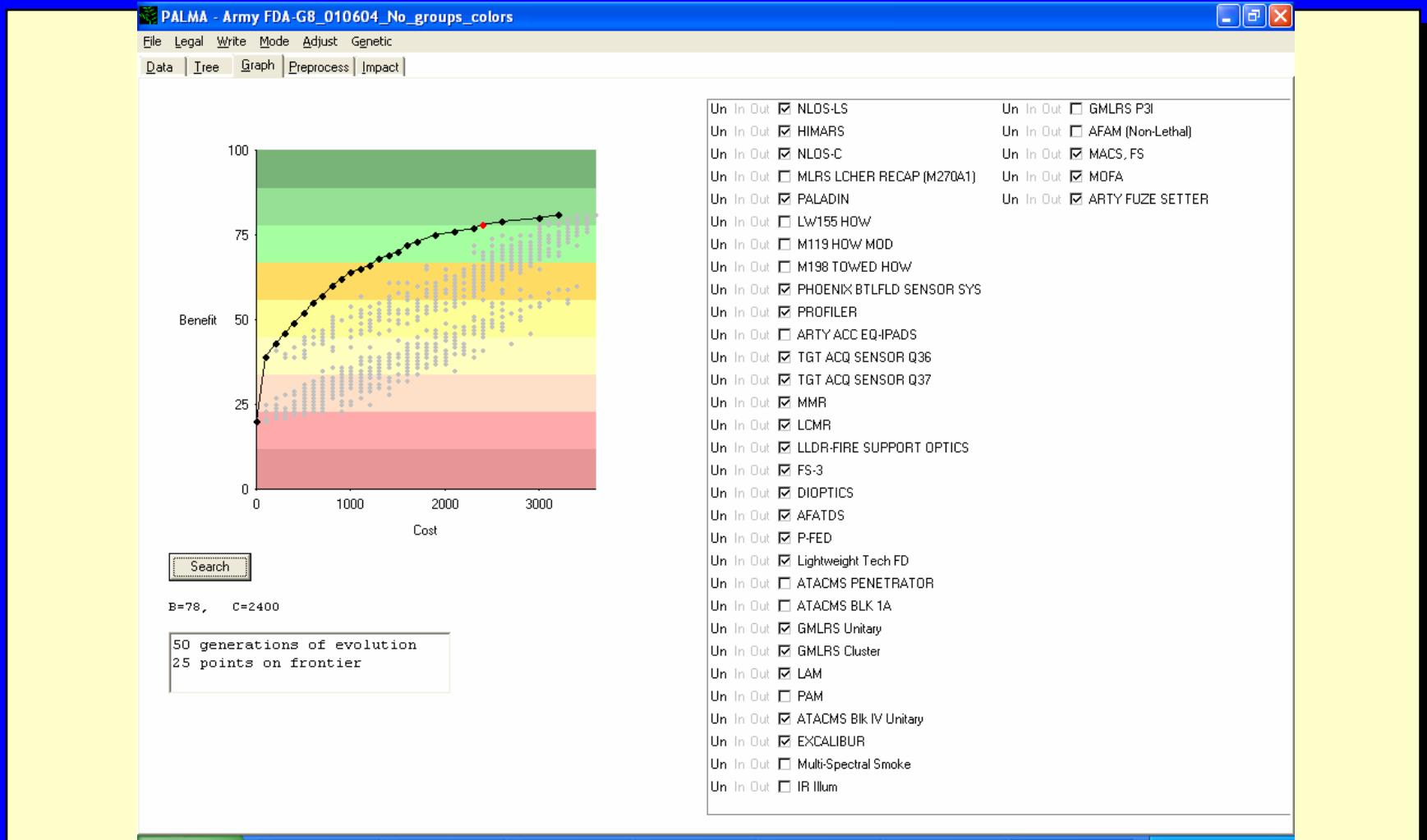
Reply with Changes... End Review...

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Efficient Frontier for Fire Support Mission



Additional PALMA Functionality

- Multi time period capability
- Accounting for dependencies between investment options (ex: If you procure LAM, you must also procure NLOS-LS)
- Ability to portray levels within a color band (“high yellow”, “low green” etc.)
- Addition of new roll-up rule functions (lim average)
 - Example: Under “Provide Destructive Fires: Point Targets” can represent SME judgment that “I’m Red unless I have both GMLRS Unitary and ATACMS Block IV Unitary systems, but need ATACMS Penetrator and LAM to reach full (Green) capability”

Why a Portfolio Analysis Approach?

With appropriate up-front investment of time and resources, portfolio analysis can be an integral component of effective budget planning and mission thread analysis

- Forcing-function for detailed assessment/decomposition of mission
 - Provides a structure that pulls in results from other architecture studies and detailed mission analyses
 - Provides an intuitive visual representation of mission
 - Supports dialog across stakeholder groups
- Can be used for quick what-ifs and sensitivity analyses after initial recommendation/assessment developed
- May only need to be “tweaked” to be relevant across years